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PTO/SB/21 (02-04) (AW 02/2004)

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Application Number	10/774,244
Filing Date	February 6, 2004
First Named Inventor	David Ferry et al.
Art Unit	3644
Examiner Name	Not Yet Determined
Attorney Docket No.	FJC-109US

ENCLOSURES (Check all that apply)

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Applicant(s): David Ferry et al.

Docket No.

FJC-109US

Serial No.

10/774,244

Filing Date

February 6, 2004

Examiner

Group Art Unit

3644

Invention: A SEATING SYSTEM AND A PASSENGER ACCOMMODATION UNIT FOR A VEHICLE



I hereby certify that the following correspondence:

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Appln. No: 10/774,244
Applicant: David Ferry et al.
Filed: February 6, 2004
Title: A SEATING SYSTEM AND A PASSENGER ACCOMMODATION UNIT FOR A VEHICLE
TC/A.U.: 3644

CLAIM TO RIGHT OF PRIORITY

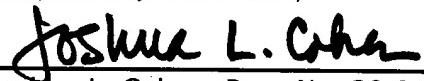
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Sir:

Pursuant to 35 U.S.C. § 119, Applicants hereby claim the benefit of prior UK Patent Application No. 0119459.6, filed August 9, 2001 and UK Patent Application No. 0202389.3 filed February 1, 2002.

Certified copies of the above-referenced applications are enclosed.

Respectfully submitted,



Joshua L. Cohen, Reg. No. 38,040
Attorney for Applicants

JLC/ap

Enclosure: Certified Copy of Patent Application Nos. 0119459.6 and 0202389.3
Dated: June 7, 2004
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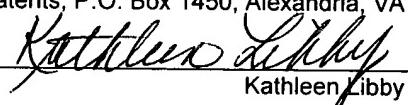
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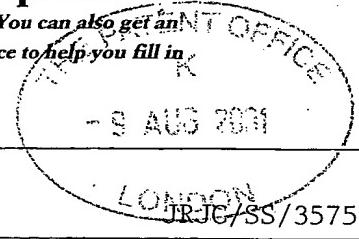
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1. Your reference

LURJC/SS/35753

2. Patent application number

(The F) **0119459.6**

9 AUG 2001

3. Full name, address and postcode or title or of each applicant (*underline all surnames*)Virgin Atlantic Airways Ltd
The Office
Crawley Business Quarter
Manor Royal
Crawley
West Sussex RH10 2NUPatents ADP number (*if you know it*)7993611002
United Kingdom

If the applicant is a corporate body, give the country/state of its incorporation

4. Title of the invention

A PASSENGER SEAT FOR A VEHICLE AND A SEATING SYSTEM FOR
A PASSENGER VEHICLE5. Name of your agent (*if you have one*)fJ Cleveland
40-43 Chancery Lane
London
WC2A 1JQ"Address for service" in the United Kingdom to which all correspondence should be sent (*including the postcode*)Patents ADP number (*if you know it*)

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Country

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(*if you know it*)Date of filing
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Date of filing
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Description 22

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to grant of a patent (*Patents Form 7/77*)Request for preliminary examination
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Date

9 August 2001

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A PASSENGER SEAT FOR A VEHICLE AND A SEATING SYSTEM FOR A PASSENGER VEHICLE

The present invention relates to a passenger seat for a vehicle. The seat of the
5 invention may be adapted for use on any passenger vehicle, including omnibuses, coaches, ferries and railway carriages. The passenger seat of the invention is particularly suitable for use in a business-class passenger cabin of an aircraft. The present invention also provides a novel seating system for a vehicle, particularly an aircraft.

10

A conventional aircraft passenger seat comprises a backrest and seat-pan which are supported off the floor by suitable supporting structure. Typically the backrest is adapted to recline somewhat in order to provide a more comfortable sitting position for a passenger during the course of their flight. Seats for use in business-class and first class sections of a passenger aircraft are typically also fitted with a leg-rest which is adapted for selective movement between a stowed position and a deployed position for added comfort in-flight. A disadvantage which is associated even with business and first-class passenger seats is that even when fully reclined they do not form a completely flat
15 surface. Many passengers find it difficult to sleep in a sitting position, even if greatly reclined, and this can represent a serious problem particularly on long-haul flights.

GB2326824A (British Airways Plc) discloses a passenger seat for use in a first-class cabin of a passenger aircraft which comprises a primary seat and an opposing secondary seat. The primary seat comprises, in the usual way, a backrest, seat-pan and leg-rest supported by a suitable supporting structure off the floor of the aircraft. The primary seat is adapted to move forwardly
25

towards the secondary seat as the primary seat reclines and, in a fully reclined position forms a substantially flat and continuous sleeping surface with the secondary seat. The seat of GB2326824A is thus particularly advantageous because it provides a seat which can be converted to form a flat bed during the course of a long-haul flight. A disadvantage with the seat of GB2326824A is that it occupies a very large floor area within the cabin and is thus only suitable for use in first-class accommodation.

5 WO 00/21831A2 (British Airways Plc) discloses a similar seating unit which is suitable for use in a business-class section of an aircraft. The mechanism of the seat of WO 00/21831A2 is substantially the same as that of GB2326824A, except that the leg-rest is omitted, with the seat-pan of the primary seat engaging directly with the opposing secondary seat. Thus, the seat of WO 00/21831 A2 also provides a substantially flat and continuous sleeping surface, 10 but does so within a smaller floor area as compared with the seat of GB2326824A. A disadvantage is, of course, that the length of the sleeping surface is reduced.

15 Other attributes of passenger seats for use in first-class aircraft cabins are generous seat widths and convenient utilities units associated with the seats such as over-sized seat-side-tables for supporting various utensils such as drinks glasses and cups. Another disadvantage associated with the passenger seat with WO 00/21831 A2 is that in order to accommodate a maximal head count within a business class cabin, the seat width is reduced, which many passengers find to be uncomfortable, and the dimensions of associated utilities 20 units such as drinks tables are also minimised to conserve space. Whilst the seat of WO 00/21831 A2 has the undeniable benefit of providing a substantially flat sleeping surface for a passenger in-flight, its overall 25

- dimensions are such that passengers of above average height and/or weight find the accommodation somewhat cramped. Furthermore, privacy screens are provided between adjacent seats which, in combination with the total number of seats provided in the limited space afforded by a business class cabin,
- 5 results in the cabin as a whole having a somewhat crowded appearance.

An object of the present invention is to provide an improved passenger seat for a vehicle.

- 10 In particular, it is an object of the present invention to provide improved passenger accommodation for the business-class section of a passenger aircraft.

Another object of the present invention is to optimise the use of space within an aircraft passenger cabin.

15

Yet another object of the present invention is to provide passenger accommodation for an aircraft which incorporates a flat sleeping surface of maximal length.

- 20 Yet another object of the present invention is to provide a seating arrangement for a cabin of a passenger aircraft which has a substantially uncrowded appearance.

- 25 Yet another object of the present invention is to provide passenger accommodation for use in a business class cabin which incorporates over-sized utilities furniture of the kind normally associated with first-class cabins.

Thus, according to one aspect of the present invention there is provided a

seating system for a passenger vehicle, particularly an aircraft, comprising a plurality of seats, each seat defining a longitudinal seat axis and comprising supporting structure adapted for attaching the seat to the floor of the vehicle and seat means comprising a seat-pan and a back-rest; characterised in that said
5 seats are arranged side by side in longitudinally off-set relation at an acute angle to the direction of travel of the vehicle, thereby defining a generally triangular or trapezoidal space to the rear of each seat; and each seat further comprises means defining a flat bed, a major proportion of which is disposed forwardly of the seat means and which extends rearwardly into said space to
10 extend the flat bed.

Preferably, each seat further comprises a footstool that is separate from the seat means and is positioned forwardly and opposing said seat means. Said footstool can thus be used by one passenger using the seat to support his or her feet in-flight in an elevated position and/or by another passenger to sit on
15 whilst visiting the one passenger.

Said acute angle may be in the range 30-60 degrees, preferably 40-50 degrees. In some embodiments, the longitudinal axis of each seat subtends an angle of
20 about 45 degrees with the direction of travel of the vehicle. Typically, said seats may be disposed adjacent to a side wall of the vehicle and face inwardly. The seats may thus have their backs to the vehicle wall, giving the cabin as a whole an uncrowded appearance.

25 In another aspect of the present invention there is provided a passenger seat for a vehicle, particularly an aircraft, which comprises supporting structure adapted to be fixably secured to the floor of the vehicle; and seat means, comprising a back-rest and seat-pan, adapted to be supported off the floor by said supporting

structure; characterised by a hollow extension box assembly arranged to extend rearwardly of the seat means; and means for providing a substantially flat bed, a major proportion of which is positioned forwardly of the seat means, which extends rearwardly into the foot-box.

5

- The use of an extension box that is positioned in accordance with the present invention, behind a passenger seat allows a substantially flat bed that is largely positioned forwardly of the seat to be extended rearwardly of the seat to provide a flat and continuous sleeping surface of maximal length within minimal space. Typically, the present invention allows beds of up to 7 feet (2.13 metres) in length to be provided within a business class passenger aircraft cabin.

- 10 Typically, said extensions assembly may be integral with the supporting structure of the seat. Said supporting structure and foot-box assembly may be manufactured from any suitable, aviation standard, lightweight material that is known to those skilled in the art.

- 15 Said seat may be positioned at an acute angle relative to the direction of travel of the vehicle and said extension box assembly might have a generally triangular or trapezoidal footprint, comprising a first lateral side that subtends an acute angle with the longitudinal axis of the seat such that the first side is adapted to be oriented substantially or generally parallelly to direction of travel. Said acute angle maybe in the range 30-60 degrees, preferably 40-50 degrees.
- 20 In some embodiments, said acute angle may be approximately 45 degrees. Said first lateral side may be closed by a side wall or may be open.

25 The extension box assembly may further comprise a second opposing side wall

that extends substantially parallelly to the longitudinal axis of the seat.

Said seat may be adapted to be positioned juxtaposed a concave side wall of the vehicle, and said extension box assembly may be configured and positioned
5 to extend into the recess formed by the concave wall, thereby optimising use of space in the cabin. Said seat may be positioned with its first lateral side juxtaposed said cabin side wall, such that where said first side is open said extension box is closed by the cabin wall.

- 10 Advantageously, the seat of the present invention may be adapted to be positioned adjacent to a similar, first neighbouring seat in a longitudinally offset, side-by-side relationship, and said extension box assembly may comprise furniture means for use by said neighbouring seat. Thus, within an aircraft cabin, seats according to the present invention may be positioned in a "herringbone" arrangement adjacent a side wall of the cabin. Preferably the
15 seats are oriented to face inwardly of the cabin to give the cabin an uncrowded appearance. Each seat may be positioned such that its seat-pan is disposed adjacent the extension box of a first neighbouring seat in front (if seats are facing forwardly), or a first neighbouring seat behind, (if the seats are facing rearwardly) such that the furniture means provided by each seat is positioned
20 conveniently for use by said first neighbouring seat. Preferably, said extension box assembly comprises a substantially or generally flat upper surface at a suitable height for use as a side-table by said first neighbouring seat. The arrangement of the present invention allows the upper surface of the extension box to be formed with a generously sized side-table for use by a passenger in
25 the first neighbouring seat for supporting drink glasses, cups, etc.

Said extension box may comprise an internal shelf adapted to support mattress

means forming part of the flat bed.

- Each seat may further comprise a footstool that is positioned forwardly of the seat means for one passenger using the seat to rest his or her feet in a raised position during the course of the flight and/or for another passenger to sit on whilst visiting the one passenger. Provided that such a footstool is provided, the applicants have found that passengers do not require aircraft passenger seats to incorporate a movable leg rest as part of the seat means.
- 10 In some embodiments, the seat further comprises a first privacy screen that is positioned forwardly of the footstool relative to the seat means. Said seat may further comprise a second privacy screen that is positioned behind the seat means. Said second privacy screen may be formed integrally with the supporting structure. Said second privacy screen may extend between the seat means and the extension box assembly and define an aperture therethrough to allow the flat bed to extend into the extension box assembly. Said first and second privacy screens may be joined by an interconnecting side wall to form an enclosure around the seat means and the footstool, thereby to define a personal space for a passenger associated with each seat.
- 15
- 20 Said interconnecting side wall may form at least part of the second opposing wall of the foot-box of a second similar neighbouring seat which is positioned adjacent to the seat in longitudinally offset relation to the opposite side of the seat from the first neighbouring seat. Conveniently, the supporting structure, first and second privacy screens and interconnecting side wall and extension box assembly may be manufactured as a single piece from a suitably robust, load-bearing, light-weight structural material. Said supporting structure may be provided with suitable anchoring means for anchoring the seat to seat tracks in

an aircraft passenger cabin.

Preferably, said extension box constitutes a foot-box, adapted to receive the feet of a passenger sleeping on the bed means. Alternatively, however, the
5 extension box may be adapted to support the passenger's head.

According to the first particular aspect of the present invention, said flat bed may be disposed substantially at floor level, extending beneath the seat-pan into the extension box. Said seat-pan may be movable between a deployed
10 position and a stowed position to facilitate access to the extension box assembly. Said seat-pan may be adapted to slide relative to the supporting structure between a fully extended position and a fully retracted position in which the seat-pan is at least partially accommodated within the extension box assembly above the flat bed. Advantageously the seat-pan may be selectively positioned in one or more intermediate positions between said fully extended
15 and fully retracted positions. Thus, a passenger using the seat may select positions of the seat-pan relative to the backrest that are suitable separately for dining and relaxing. Alternatively, the seat-pan may be mounted pivotally on the supporting structure, such that said seat-pan may be selectively pivoted upwards to lie contiguously against the backrest. As will be appreciated by
20 those skilled in the art, it is merely necessary that the seat-pan should be movable from its normal deployed position to facilitate access by a passenger to the extension box.

25 Said flat bed may comprise tray means adapted to support a mattress, and said seat may further comprise removable false floor means disposed over the tray means and adapted to protect a mattress when not in use. Said false floor means may comprise a panel positioned forwardly of a seat-pan. In some

embodiments the panel may be pivotally connected to or adjacent to the interconnecting side wall such that the panel may be selectively pivoted upwardly to lie against said interconnecting side wall to allow access to the flat bed. Optionally the panel may be upholstered on its underside such that in the 5 stowed position, the upholstered panel may form a sofa-like arrangement with the flat bed.

Said tray means may be built into a plinth that extends under the entire seat and provides a step-up from the vehicle floor into the seat.

10 Said flat bed may extend beneath the footstool, and said footstool may be selectively removable to allow access to the bed. In some embodiments the footstool may be adapted to slide substantially on a vertical axis between a lower deployed position and an elevated stowed position. For example, the 15 footstool may be adapted to slide in runners formed on the first privacy screen.

Alternatively, the footstool may be completely removable from its deployed position. When adapted for substantially vertical movement between a lower deployed position and a raised stowed position, the footstool may be shaped to provide an extension to the first privacy screen in the raised position.

20 Advantageously the second side wall of the extension box assembly may be formed with an external recess at substantially the same level as the seat-pan, which recess is provided with upholstered shelf means to provide a lateral seat-pan extension for the first neighbouring seat.

25 According to a second alternative aspect of the invention, the seat means may be movable between a seat mode in which a passenger may sit on the seat means, and a bed mode to form said flat bed at substantially the same level as

the seat-pan. Said supporting structure may comprise an under-seat pan that is adapted to support the seat-pan in the seat mode and extend rearwardly into the foot-box assembly through an aperture in the supporting structure. Said under-seat-pan, seat-pan and backrest may be interconnected such that the seat means 5 can be selectively unfolded to form a flat bed comprising an upper surface of the under-seat-pan, a surface of the seat-pan and a rear surface of the backrest; which surfaces are substantially co-planar and are cushioned.

Advantageously, therefore, different surfaces of the seat-pan and back-rest may 10 be used in the seat mode and bed mode respectively. Neither of the upper surface of the seat pan and front surface of the back-rest form part of the bed means and may therefore be upholstered with materials suitable for use on a seat. Similarly none of the above mentioned surfaces of the under-seat-pan, seat-pan and back-rest used to form the bed means are used in the seat mode, 15 and accordingly thereafter surfaces may be upholstered in a manner suitable for use as a bed. Moreover, the materials used to upholster the seat components used respectively in seat mode and bed mode may be differently coloured and/or textured and/or patterned from one another so as to create a first ambience or a "mood" in a cabin when all or a majority of seats are configured 20 in one of said modes, and second different ambience or "mood" when all or a majority of the seats are configured in the other mode.

Said seat may further comprise a footstool, and said seat means, when unfolded to form said flat bed, may be arranged to be supported by the footstool. In the 25 bed mode, the unfolded seat means may overlay the footstool.

Said seat means may further comprise an upholstered backrest extension portion that is fixably secured to the supporting structure above the backrest in

the seat mode. Said supporting structure may extend behind the seat means and may be provided with an aperture to allow said flat bed to extend therethrough into the extension box. Said aperture may be formed below the backrest extension portion, and may be positioned behind the backrest when the
5 backrest is positioned in the seat mode.

The present invention thus provides a novel seating system which is particularly suitable for a business-class cabin of a passenger aircraft. The seating system of the present invention provides individual seats having
10 backrests and seat-pans and associated footstools to allow passengers to rest their legs to a raised position during a flight. Each seat is provided with means to form a substantially flat bed and use of space within the cabin is optimised by positioning the flat bed to extend rearwardly behind the seat means into a space or extension box. The area occupied by the extension box may be fully
15 utilised in accordance with the present invention by providing furniture means within that space for use by an adjacent seat. For example, the extension box may be provided with an integral side-table of generous proportions. The flat bed may be provided at floor level or at seat level and, in the case of the former, the extension box may be additionally shaped to provide a lateral seat
20 extension for a neighbouring seat. Surprisingly, the applicants have found that in accordance with the present invention it is possible to provide flat beds within the business-class section of a passenger aircraft having a length of up to 7ft (2.13 metres), without substantially sacrificing head-count. Furthermore, the applicants have found that the seats of the present invention may be
25 positioned to give the cabin a substantially uncrowded appearance and may be designed to provide many features normally associated with first-class accommodation.

Following is a description by way of example only with reference to the accompanying drawings of embodiments of the present invention.

5 In the drawings:-

Figure 1 is an isometric view of an aircraft passenger seat according to a first embodiment of the present invention, shown in a seat mode.

- 10 Figure 2 is an isometric view of the passenger seat of the first embodiment, shown in a bed mode.

Figures 3a - 3c show schematically in side elevation the interconversion of the seat between the bed mode and the seat mode.

15

Figure 4a is a schematic isometric view of the passenger seat according to the first embodiment, showing a passenger using the seat in the seat mode.

20

Figure 4b is a schematic isometric view of the seat according to the first embodiment, showing a passenger using the seat in the bed mode.

Figure 5 is an isometric view of an aircraft passenger seat according to a second embodiment of the present invention shown in a seat mode.

25

Figure 6 is an isometric view of the passenger seat of the second embodiment shown in a bed mode.

Figure 7a is a schematic isometric view of the seat of the second embodiment

showing a passenger using the seat in the seat mode.

Figure 7b is a schematic isometric view of the seat of the second embodiment showing a passenger using the seat in the bed mode.

5

Figure 8 is an isometric view of a variant of the seat of the second embodiment which comprises a sliding seat-pan.

Figures 9a - 9c show schematically inside elevation different positions of the
10 seat-pan.

Figure 10 is an isometric view showing a further variant of the passenger seat of the second embodiment.

15 Figure 11 shows in schematic plan view a seating system of the present invention as applied to the upper and main decks of a Boeing 747-400 aircraft.

With reference to Figures 1 and 2 of the accompanying drawings, a seating unit according to a first embodiment of the present invention comprises a shell
20 assembly 10 that is assembled from two half-shells 10a, 10b. The seating unit of the present invention is intended to be positioned in the passenger cabin of an aircraft in juxtaposition with at least one neighbouring seat 10'. The two half-shells 10a, 10b are similar to one another, and each forms apart of two adjacent seats. Each half-shell 10a, 10b is manufactured as a single piece from
25 a suitable aircraft-grade light-weight structural material.

The shell 10 of each seating unit comprises a curved, upright rear screen 12 and an opposing, upright, curved front screen 14 which are interconnected by a

generally linear side wall 16 to form an enclosed passenger space 18.

Said shell 10 comprises a bottom edge 11 which defines a plane and is provided with a plurality of suitable fixings (not shown) for attaching the seating unit to the seat tracks in the aircraft cabin. The inventors have found that in some embodiments the seating unit may be adequately secured to the seat tracks using three such fixings.

Said shell 10 provides a suitable supporting structure for a seat assembly 20 which comprises a seat-pan 22, a backrest 24 and a backrest extension 26. In particular, the shell 10 of the seating unit comprises an under-seat-pan 28 (see Figure 2) that is disposed adjacent to the rear screen 12 and has a generally flat, horizontal upper surface that serves to support the seat-pan 22. Said seat-pan 22 is pivoted to the subseat-pan 28 at its forward edge 23, and the backrest, which normally rests in a generally upright position against the internal surface of the rear screen 12, is pivoted at its lower end 25 to the rear end of the seat-pan. Said backrest extension 26 is permanently fixed to the internal surface of the rear screen 12 at a position above and substantially contiguous to the upper edge of the backrest 24 in its normal position as described above.

Said enclosed passenger space 18 further comprises a pedestal 40 that is supported above the cabin floor on the shell 10 adjacent the front screen 14. Optionally, said pedestal 40 may be height adjustable in any convenient manner known to those skilled in the art.

Behind the rear screen 12, the shell 10 of the seating unit is shaped to define a hollow foot-box 30 (see Figures 4a and 4b). In Figures 1 and 2, the foot-box

30' of the neighbouring seat is shown. Said foot-box 30 includes an internal, generally horizontal shelf which is positioned at substantially the same vertical level as the subseat-pan 28, and an aperture 29 is formed in the rear screen 12 of the shell 10 immediately behind the backrest 24 in its normal position to 5 allow access to the interior of the foot-box 30.

Said foot-box comprises a first side wall 32 which forms part of the interconnecting side wall 16 of the shell 10 of the neighbouring seat and is oriented substantially parallelly to the longitudinal axis of the seating unit. The 10 foot-box 30 further comprises a second opposing side wall 34 that subtends an acute angle with the longitudinal axis of the seat such that the foot-box has a generally triangular or trapezoid shape in plan view. In Figures 1-4 of the accompanying drawings, the foot-box of the seat of the first embodiment has a generally triangular shape, but those skilled in the art will appreciate that the 15 foot-box could be truncated with an end wall between the two side walls 32, 34 to form a trapezoidal shape. Alternatively, where the seat is intended to be positioned juxtaposed a wall, the first side wall 32 may be omitted such that the first lateral side of the foot-box is open. The foot-box 30 terminates below the upper edge of the rear screen 12 with a generally flat top wall 36. Said top 20 wall 36 is formed with a generally triangular flat portion 38 which serves as a drinks side-table for the neighbouring seat.

As shown in Figure 2, the upper surfaces of the shelf within the foot-box 30 and the under seat-pan 28 are cushioned with thick padding or support a 25 mattress portion 52. Similarly, the underside of the seat-pan 22 and the rear side of the backrest 24 are cushioned.

In a "seat mode" the seat-pan 22 and backrest 24 are positioned normally as

- shown in Figures 1, 3a and 4a such that a passenger may sit on the seat. However, when the passenger decides to go to sleep, he or she may get up from the seat and manually pull the backrest 24 away from the rear screen 12. The backrest 24 will pivot relative to the seat-pan 22, and continued pulling of the backrest 24 will cause the rear end of the seat-pan 22 to lift upwardly away from the under-seat-pan and pivot about its front edge 23 as shown in Figure 3b. The seat-pan 22 and backrest 24 can be manipulated as shown in Figures 3c and 4b to provide a substantially flat and continuous sleeping surface in which the front side of the backrest 24 is supported on an upper surface of the pedestal 40, the joints between the backrest 24, seat-pan 22 and under-seat-pan 28 locking in the flat position as shown in Figure 3c to form a "bed mode".
- The passenger may then lie down on the flat surface with his or her head towards the front screen 14. By removing the backrest 24 from the rear screen 12, the aperture 29 through the shell 10 is exposed allowing the passenger to extend his or her lower legs through the aperture into the foot-box 30. In the bed mode, the cushioned upper surfaces of the shelf and under-seat-pan 28 and the underside of the seat-pan 22 and rear side of the backrest 24 may be fitted with suitable bed linen such as sheets and blankets, and a pillow for the passenger may be placed on the rear of the backrest 24. An advantage of the present invention is that the surfaces of the seat used in the bed mode may be upholstered and dressed differently from that used in the seat mode. When all of a majority of the seats in the cabin are in one or other of the modes then a particular ambience can be created within the cabin.
- By positioning the seating unit of the first embodiment of the invention at an angle of about 40-50 degrees, preferably about 45 degrees to the direction of travel of the aircraft, a full bed length of up to 7ft (2.13 metres) may be provided for the passenger, and at the same time, a side-table 38 is also

provided of generous proportions, of the kind normally associated with first-class accommodation.

A passenger seat according to a second embodiment is illustrated in Figures 5-
5 10. Many of the elements of the seat of the second embodiment are similar to
corresponding components in the seat of the first embodiment described above.
Accordingly, for clarity, such components will be referred to by the same
reference numerals as in the first embodiment plus 100. Thus, for example,
whilst the rear screen is referred to in connection with the first embodiment
10 shown in Figures 1-4 as item 12, the rear screen of the seat of the second
embodiment is referred to by reference 112.

Thus, as shown in Figure 5, the passenger seat of the second embodiment
comprises a shell 110 which is formed from two half shells 110a and 110b.
15 Said shell 110 comprises a rear screen 112 and a front screen 114 that are
interconnected by an interconnecting side wall 116. Behind the rear screen
112, the shell comprises a hollow foot-box 130 having side walls 132, 134 and
a top wall 136 which includes a substantially flat, horizontal portion 138 that
serves as a drinks side-table for a neighbouring seat.

20 Unlike the seat of the first embodiment, the shell 110 of the seat of the second
embodiment is not connected directly to seat tracks in the floor of the aircraft,
but is mounted on a plinth 160. Said plinth 160 is manufactured from a
suitable aircraft grade, light-weight, structural material, typically the same
25 material as the shell 110 and has a planar bottom wall 162 which is fitted with
suitable fixings (not shown) for fixing the plinth substantially to the seat tracks.

Said plinth 160 is formed with a recess 164 which is defined by upstanding

side wall 163 and an inwardly directed upper rim 165. Said recess 164 extends from the front screen 114 under the entire seat into the foot-box 130 which is portioned at floor level. The recess 164 accommodates a mattress or similar cushioning or padding suitable for forming a bed for a passenger. Juxtaposed 5 the front screen 114, the shell 110 carries a movable pedestal 140 which is movable on a substantially vertical axis between a lower deployed position as shown in Figures 1 and 7a and a raised stowed position as shown in Figure 7b. Whilst various mechanisms for achieving such movement of the pedestal will be obvious to those skilled in the art, an example of a suitable mechanism 10 would be inter-engaging runners fitted on the inner surface of the front screen 114 and on the pedestal 140. Suitable means are provided for locking the pedestal 140 in the upper and lower positions.

Said shell 110 defines a personal passenger space 118 which accommodates a 15 seat assembly 120 comprising a seat-pan 122 and a backrest 124. Said backrest 124 is permanently fixed to the inner surface of the rear screen 112, whilst the seat-pan is pivoted at its rear edge 123 to the inner surface of the rear screen 112 for movement between a deployed position as shown in Figures 5 and 7a and a stowed position as shown in Figure 6 and 7b. In the deployed 20 position the front edge 125 of the seat-pan 122 is supported by inwardly directed protrusions 152 formed on the shell 110 which constitutes supporting structure for the seat assembly 120.

Beneath the seat-pan 122, the rear screen 112 of the shell 110 is formed with 25 an aperture 129 to allow access from the passenger space 118 into the interior of the foot-box 130. Said mattress extends beneath the seat assembly 120 through the aperture 129 into the foot-box 130.

Intermediate the seat-pan 122 and pedestal 140, the recess 164 is covered by a removable false floor panel 170 which is made from a suitable aviation standard, load-bearing material. Said false floor panel 170 is preferably connected to said interconnecting side wall 116 for movement between a deployed position as shown in Figure 5 and a stowed position in which the panel 170 extends substantially vertically and lies contiguous the side wall 116. Securing means are provided for securing the panel in the stowed position.

Juxtaposed the seat-pan 122 of a neighbouring seat, the first side wall 132 of the foot-box is formed with an external recess 133 which is provided with an upholstered shelf 135 at the same level as the seat-pan 122 to provide a lateral extension of said seat-pan 122.

Said seat assembly 120 of the seat of the second embodiment can thus be selectively manipulated between a "seat mode" as shown in Figures 5 and 7a in which the seat-pan 122 is deployed and a "bed mode" as shown in Figures 6 and 7b in which the seat-pan 122 is pivoted upwardly about its rear edge 123 to lie flat against the inner surface of the backrest 124 in the stowed position. In the bed mode, the removable false floor panel 170 can be moved to the stowed position, and the pedestal 140 raised from its lower position to its raised position thereby to expose the mattress within the recess 164 of the pedestal 160. Raising the seat-pan 122 to its stowed position facilitate access to the foot-box 130 and provides a more spacious personal space 118 within the shell 110 in the bed mode.

25

Thus, in the seat mode as shown in Figure 7a, a passenger may sit on the seat assembly 120 and, if desired, may rest his or her feet on the pedestal 140 in its lower position. If the passenger desires to go to bed, then he or she may stand

- up and lift the seat-pan 122 to its stowed position as shown in Figure 7b. The pedestal 140 may be raised to its elevated position and the false floor panel 170 may be removed. The passenger may then lie down on the mattress within the recess 164 with his or her head towards the front panel 114 and his or her lower legs extending into the foot-box 130. By orienting the seat of the second embodiment of the invention at an angle of about 40-50 degrees, for example about 45 degrees to the direction of travel of the vehicle, an overall bed length of up to about 7ft (2.13 metres) may be provided. The front screen 114 serves to protect the passengers' head whilst asleep, and the pedestal 160 provides a step-up into the passengers' personal space which many passengers find attractive. The shell above the foot-box may be shaped to provide a lateral seat extension 135 for the seat pan 122 of a neighbouring seat and a generously proportioned occasional side-table 138 for use by the neighbouring seat.
- In a variant of the seat of the second embodiment, the seat-pan 122, instead of pivoting about its rear edge 123 to lie flat, in its stowed position, against the front surface of the backrest 124 may be arranged to slide relative to the shell 110 between a forward position as shown in Figure 9a and a retracted position as shown in Figures 8 and 9c. In the retracted position, the seat-pan 122, or at least a major proportion of the seat-pan 122 may be accommodated within the foot-box 130 at a position vertically spaced above the mattress. Various mechanisms suitable for achieving such sliding movement of the seat-pan 122 will be self-evident for those skilled in the art, for example linear bearings provided on the interior surfaces of the shell 110 adjacent to the seat-pan 122. Advantageously, the sliding mechanism may be provided with one or more detents (not shown) for selectively halting movement of the seat-pan 122 in at least one intermediate position such as that shown in Figure 9b. Thus, in the fully extended position, as shown in Figure 9a, the seat assembly may be

configured ergonomically for relaxing, whilst in the intermediate position as shown in Figure 9b, the seat assembly may be configured for a more upright passenger position which is suitable, for example, for dining or working. In the fully retracted position, the seat-pan 122 is substantially stowed to allow 5 access to the foot-box 130 when the seat is in bed mode.

Another variant of the seating unit of the second embodiment is shown in Figure 10 in which the removable false floor panel 170 is pivoted to the interconnecting side wall 116 for movement between a deployed position in 10 which it lies generally horizontal over the recess 164 to protect the mattress and a stowed position as shown in Figure 10 in which it lies flat in a substantially vertical orientation against the interconnecting side wall 116. The underside 172 of the false floor panel 170 may be upholstered with suitable cushioning, such that together with the mattress 164, it provides a sofa-like 15 arrangement; a passenger may sit sideways on the mattress 164 in the bed mode with his or her back resting against the underside 172 of the panel 170:

A seating system in accordance with the present invention is illustrated in Figure 11. The particular system of Figure 11 is designed specifically for use 20 on the main and upper decks of a Boeing 747-400 aircraft, but it will be apparent to those skilled in the art that the system may be adapted for use on any passenger aircraft, particularly in a business class cabin. The seating system of Figure 11, on each of the main and upper decks, comprises a plurality of seats 200 in accordance with the present invention, for example the 25 seating units of the first or second embodiments. Each of said seats 200 is positioned juxtaposed a cabin side wall 210 and is oriented at an angle of about 40-50 degrees, preferably about 45 degrees, to the longitudinal direction of the juxtaposed side wall 210, with the rear of the seat towards the wall 210, such

that the seat faces generally inwardly of the cabin. By orienting seats 200 to face inwardly, the cabin is given a less crowded appearance as compared with a cabin in which seats are aligned substantially fore-and-aft. Each seat has a generally triangular or trapezoidal extension box or space 230 between the rear 5 of the seat and the juxtaposed cabin side wall 210. Generally, the walls of an aircraft cabin are concave on the interior, and accordingly the extension box or space 230 of each seat 200 extends into the concave recess defined by the wall to optimise the use of space in the cabin. Each seat 200 comprises means to provide a bed as described above which extends into the extension box or 10 space to maximise the available bed length.

In some aircraft floor plans, there may also be sufficient space to dispose one or more seats towards the centre of the cabin as shown for the main deck of the Boeing 747-400 in Figure 11. In that embodiment, two central lines of 15 seats are provided in which each seat is oriented at an angle of about 45 degrees to the direction of travel of the aircraft. The central seats 200 are arranged in pairs, with each seat facing generally forwardly and outwardly of the cabin such that the two seats of each pair diverge from one another in the forwards direction and define a generally quadrilateral space behind the seats in 20 front of the pair of seats behind. Said quadrilateral space 240 accommodates an extension box or space associated with each seat 200 in order to provide an extended bed length for each seat. Where each seat 200 comprises a hollow foot-box of the kind described above in connection with the first and second embodiments, the top wall of each foot-box may be adapted to provide a 25 convenient side-table or other furniture means for another seat.

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Concept 5a & 5b

Side table

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Both herringbone concepts feature a well sized triangular side table which is situated above the footwell of the passenger in front. This is a highly efficient way of creating a unit with First Class features within a Business Class headcount.

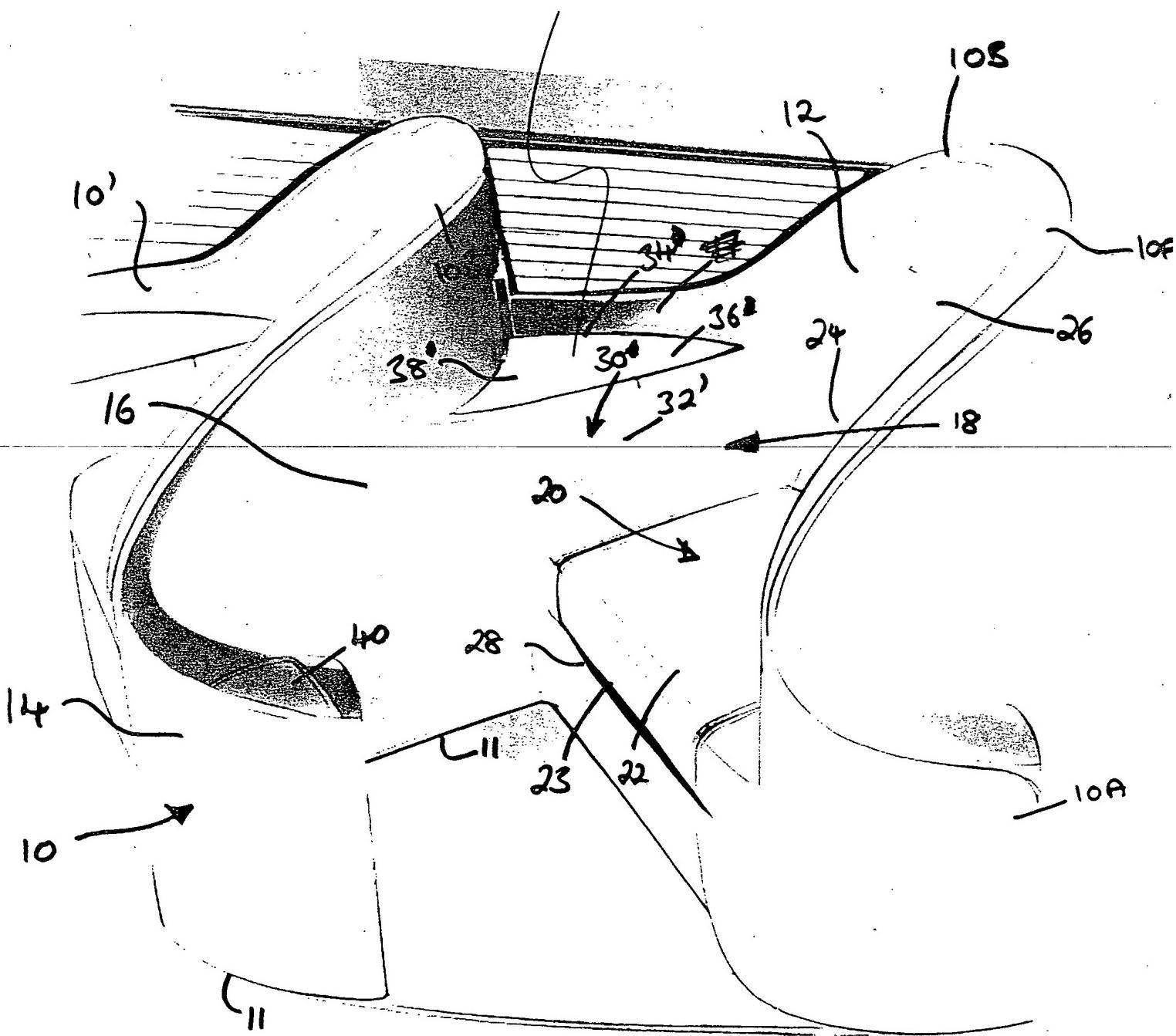
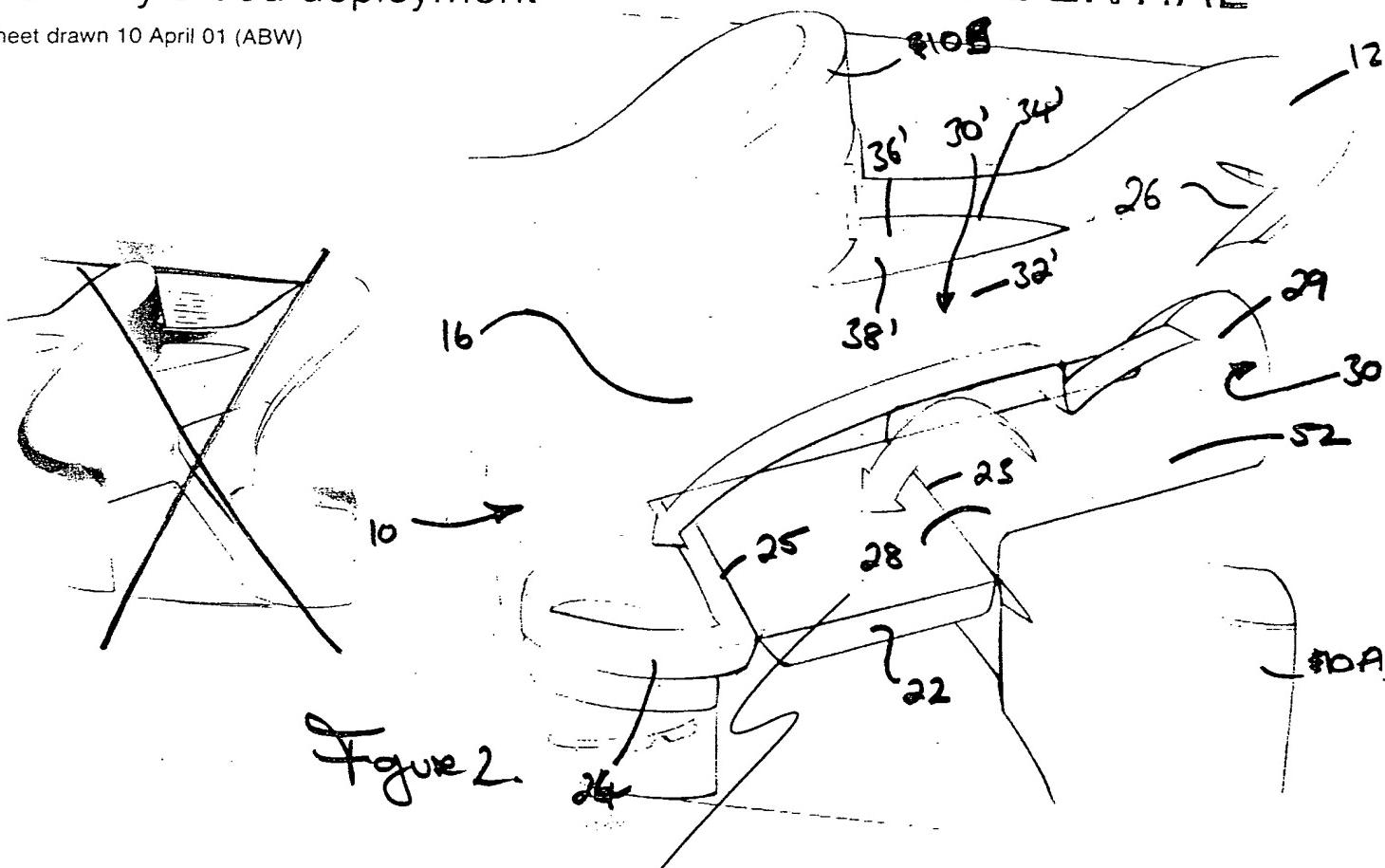


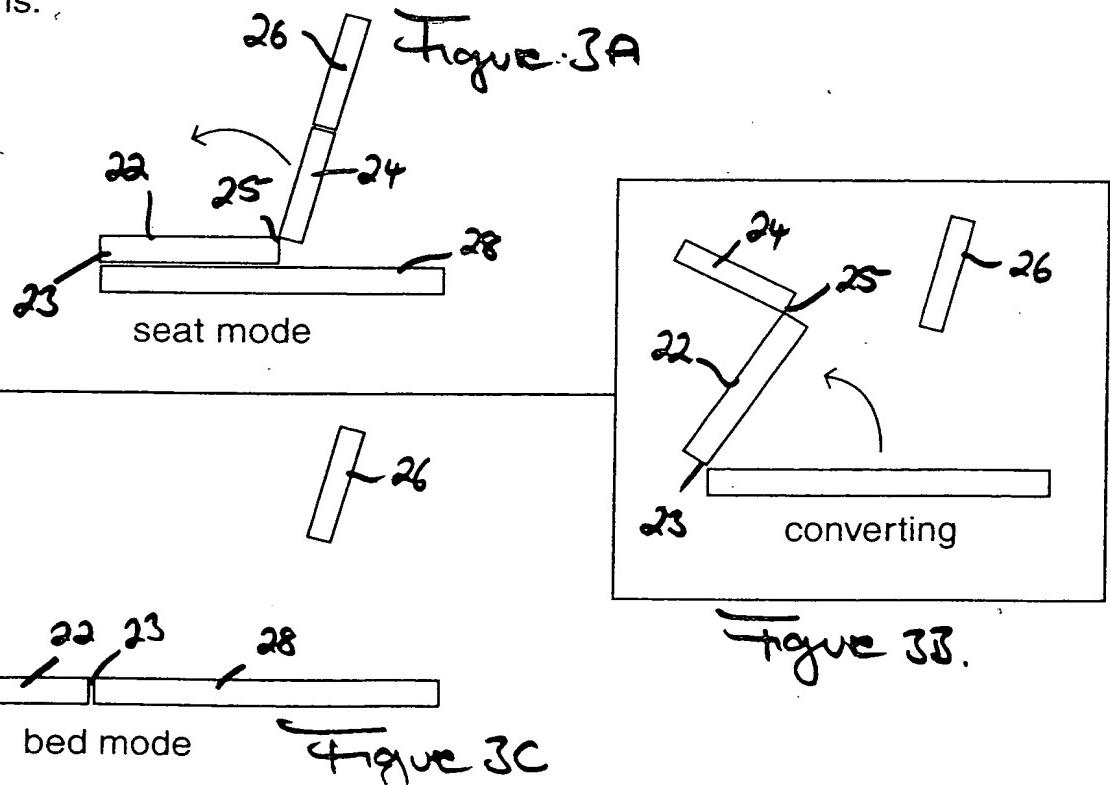
Figure 1.

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The seat-pan and a portion of the seat-back fold forward to create a bed that stretches from the footstool right through the seat-back and beneath the side-table of the passenger behind. Foaming can therefore be optimised for seating comfort on one side and flat as a bed on the other side of both the seat-pan and seat-back cushions.



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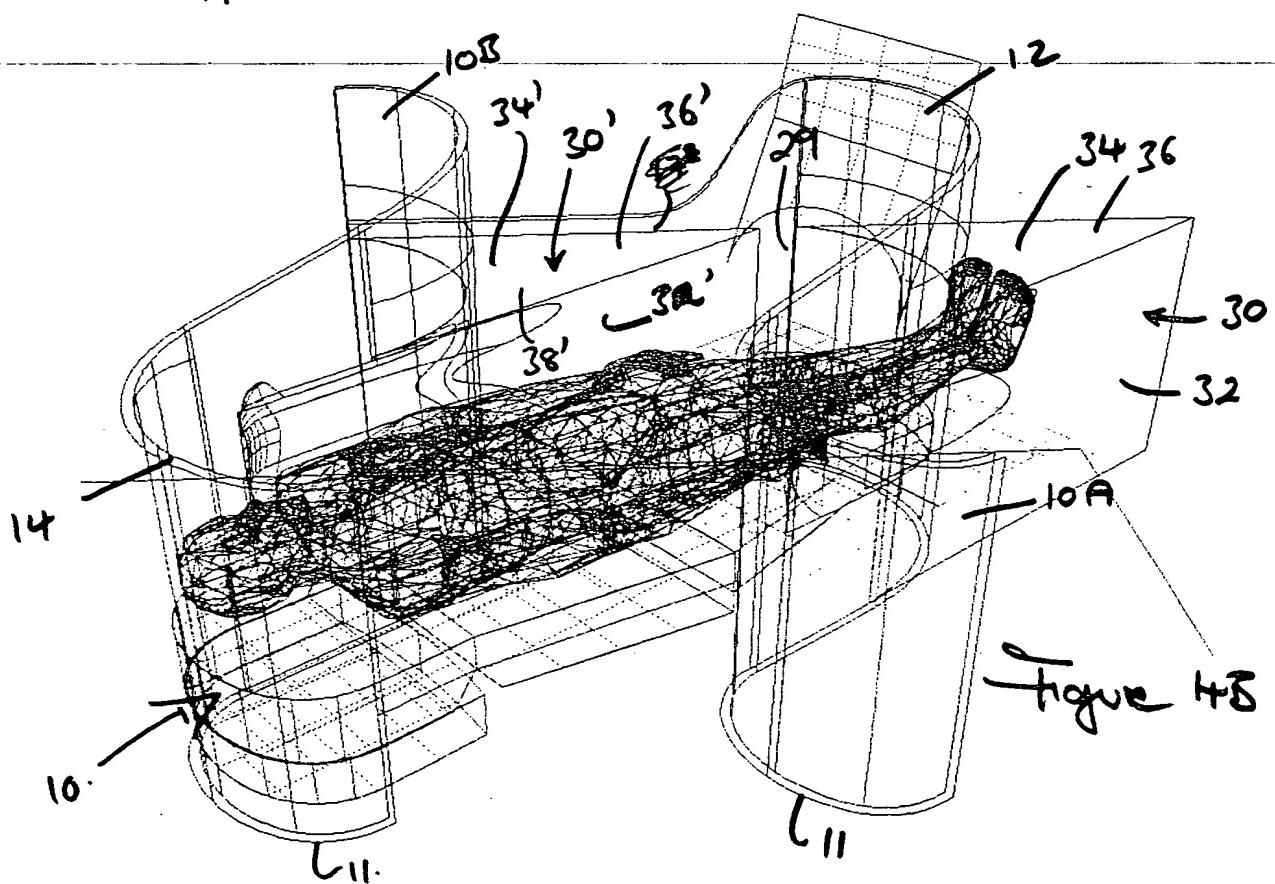
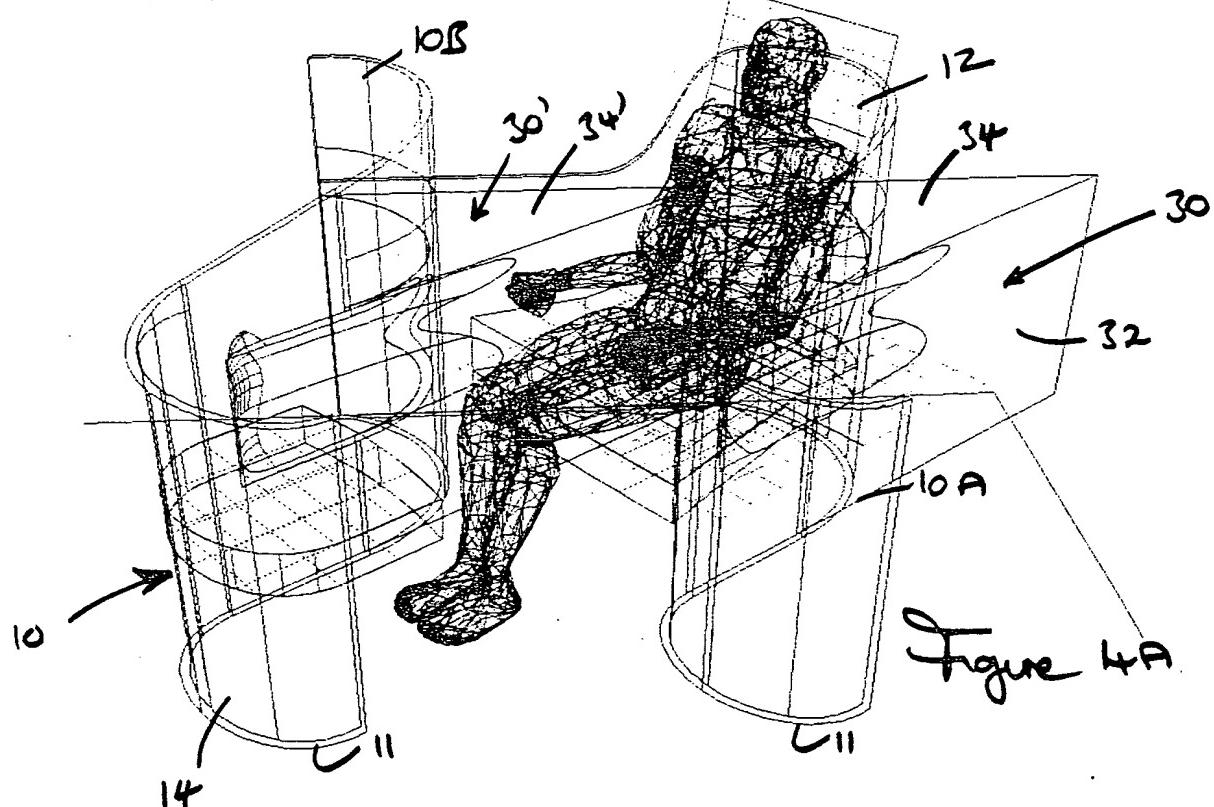
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Concept 5a

"Futon" style unit: seat/bed positions

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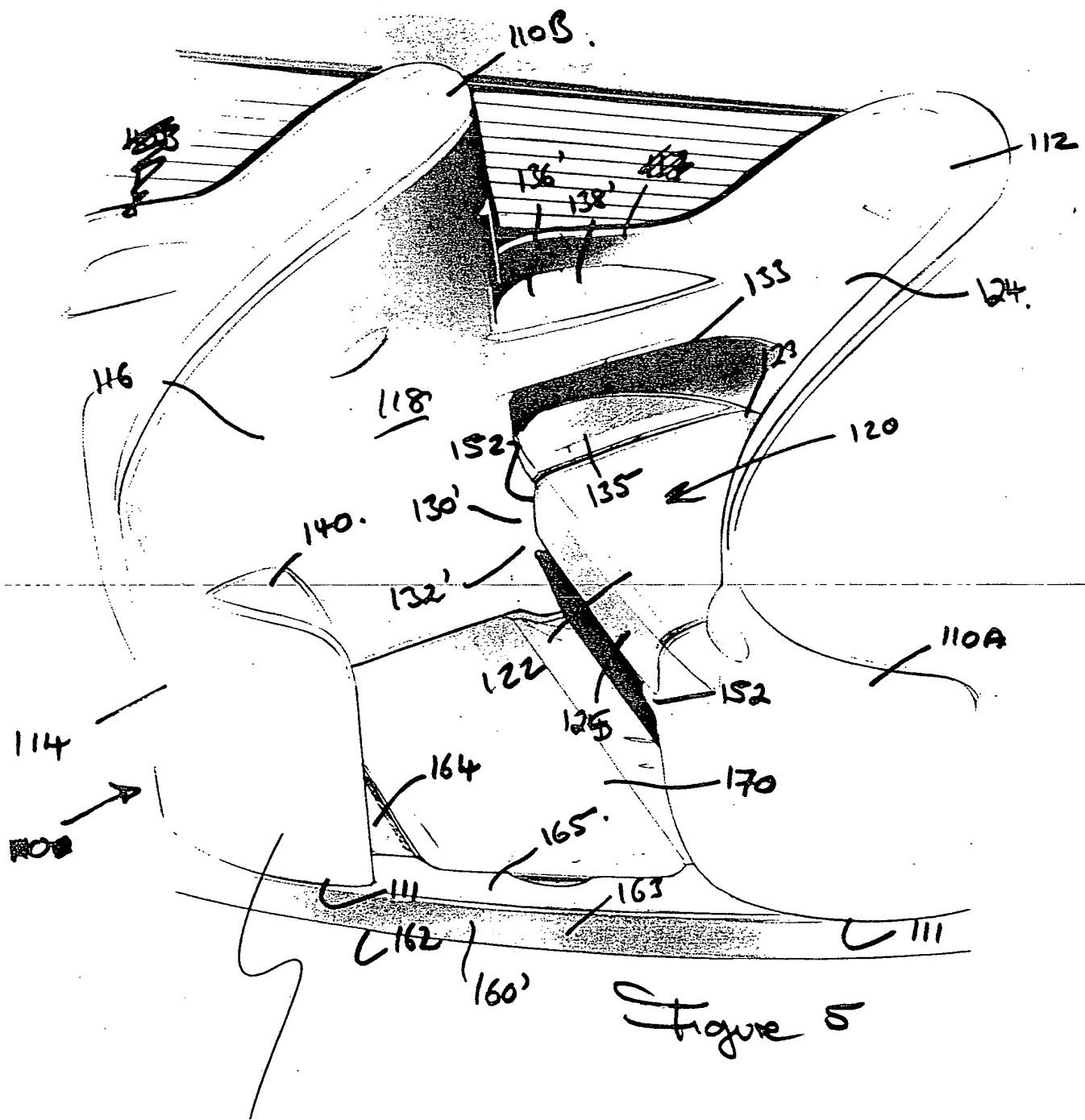
The above image shows the positions of the seat and futon-style bed and how they would be used by passengers

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Concept 5a & 5b
Aisle Shield

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Protective shield between sleeping head position and aisle.

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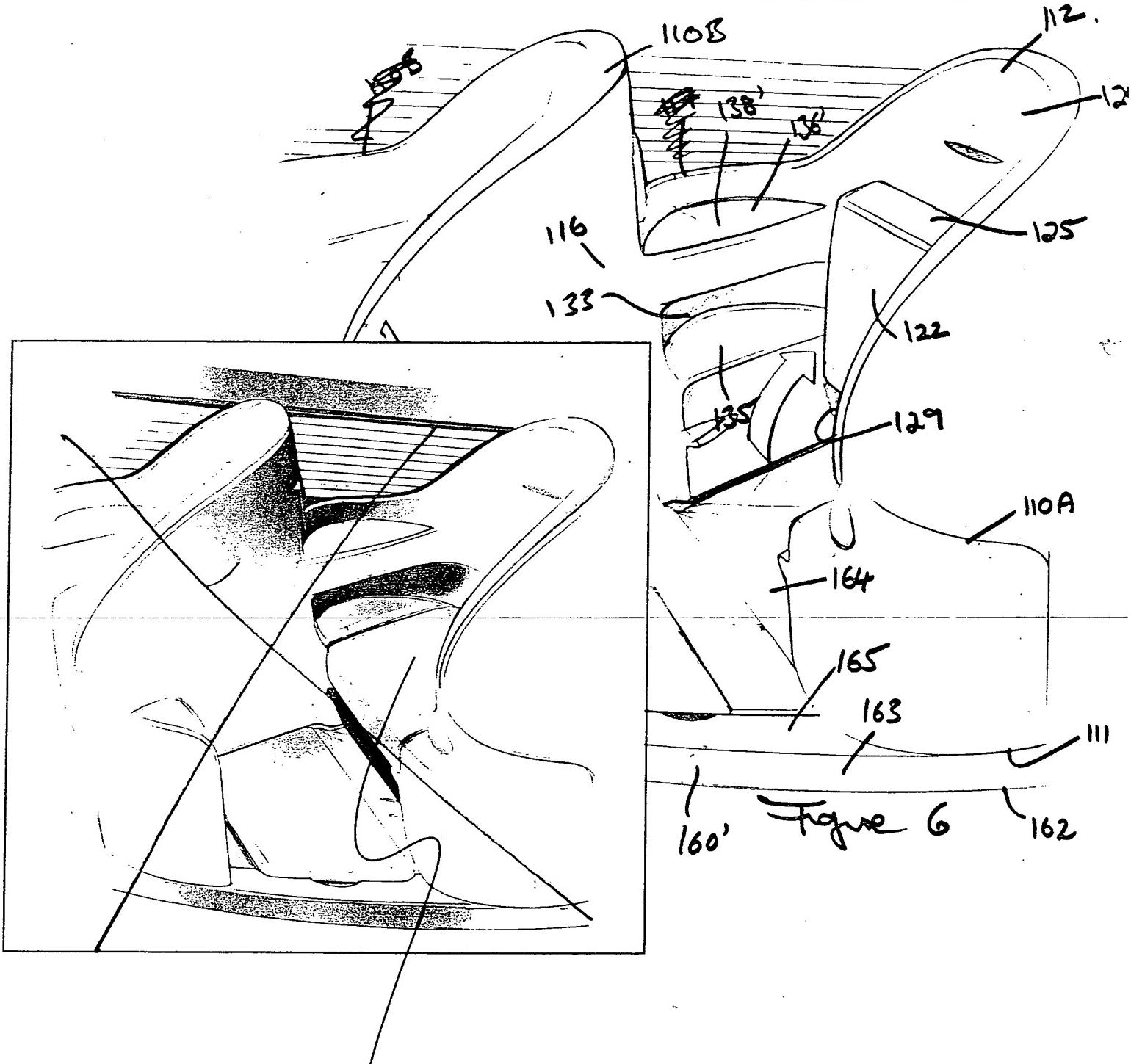
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Concept 5b

Seat option 1: Flip-up seat-pan

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Seat-pan is hinged at back so that it can be moved into an upright position, out of the way for the bed mode. The hinge-point is raised above the top surface of the seat-pan so that the pan lifts upwards as it is rotated, giving extra clearance underneath.

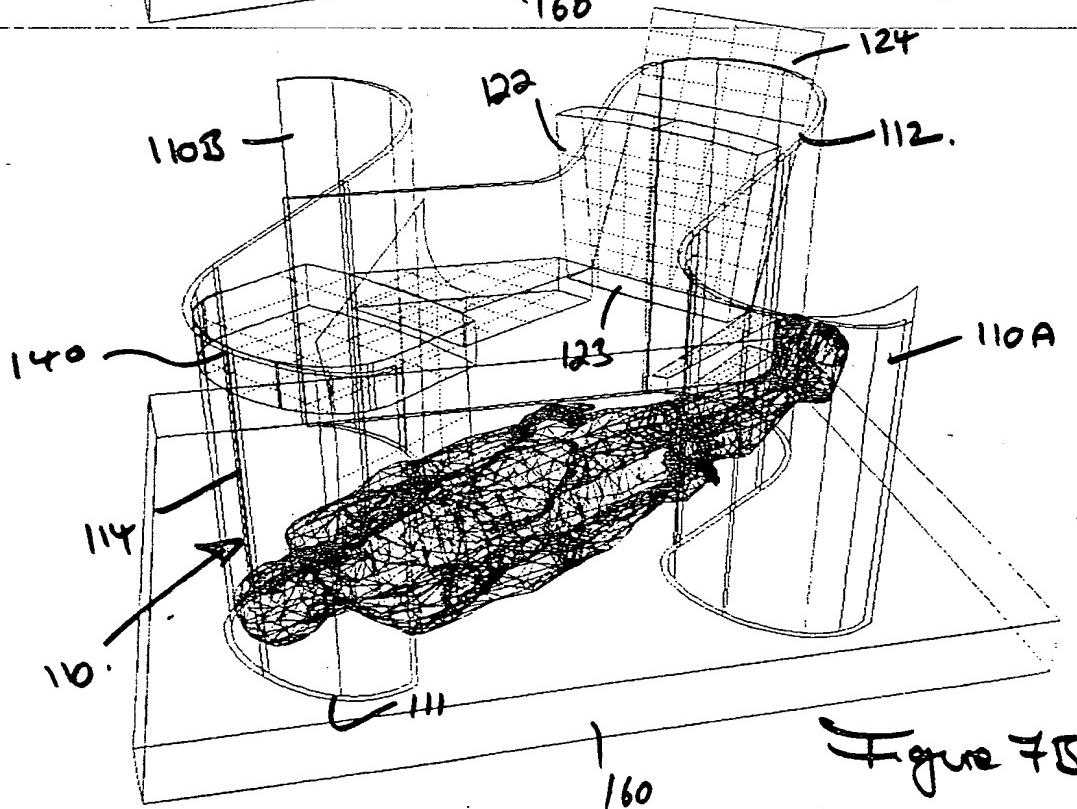
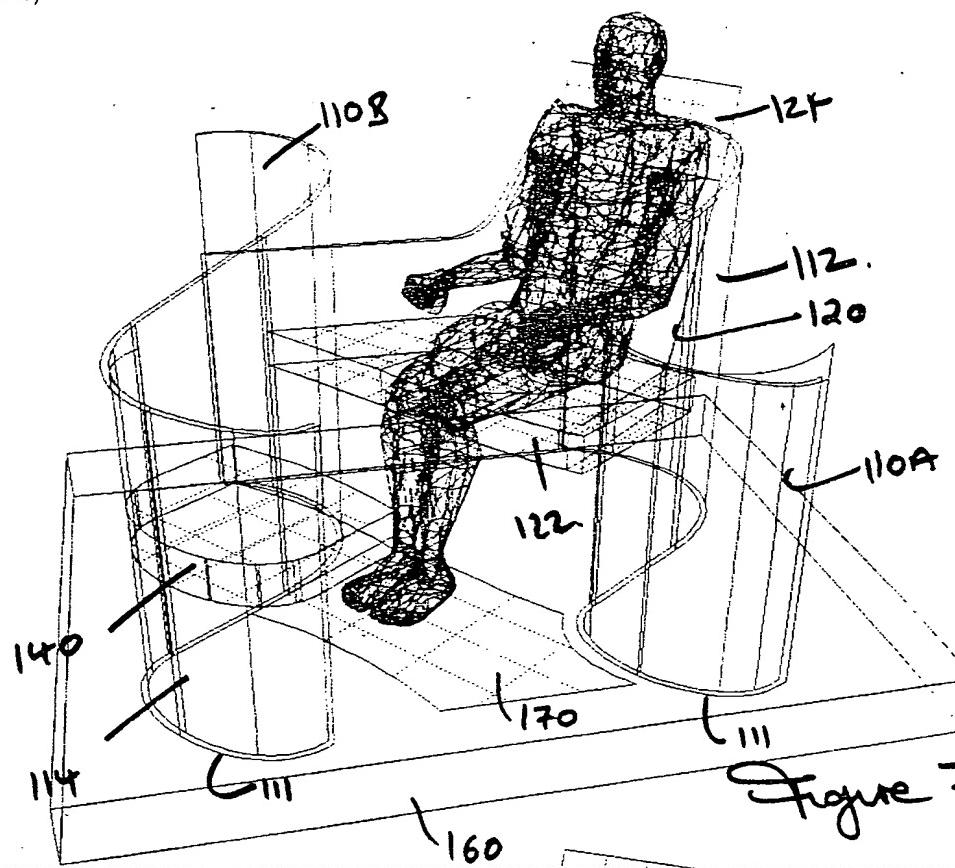
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Concept 5b

● Floor-bed unit: seat/bed positions

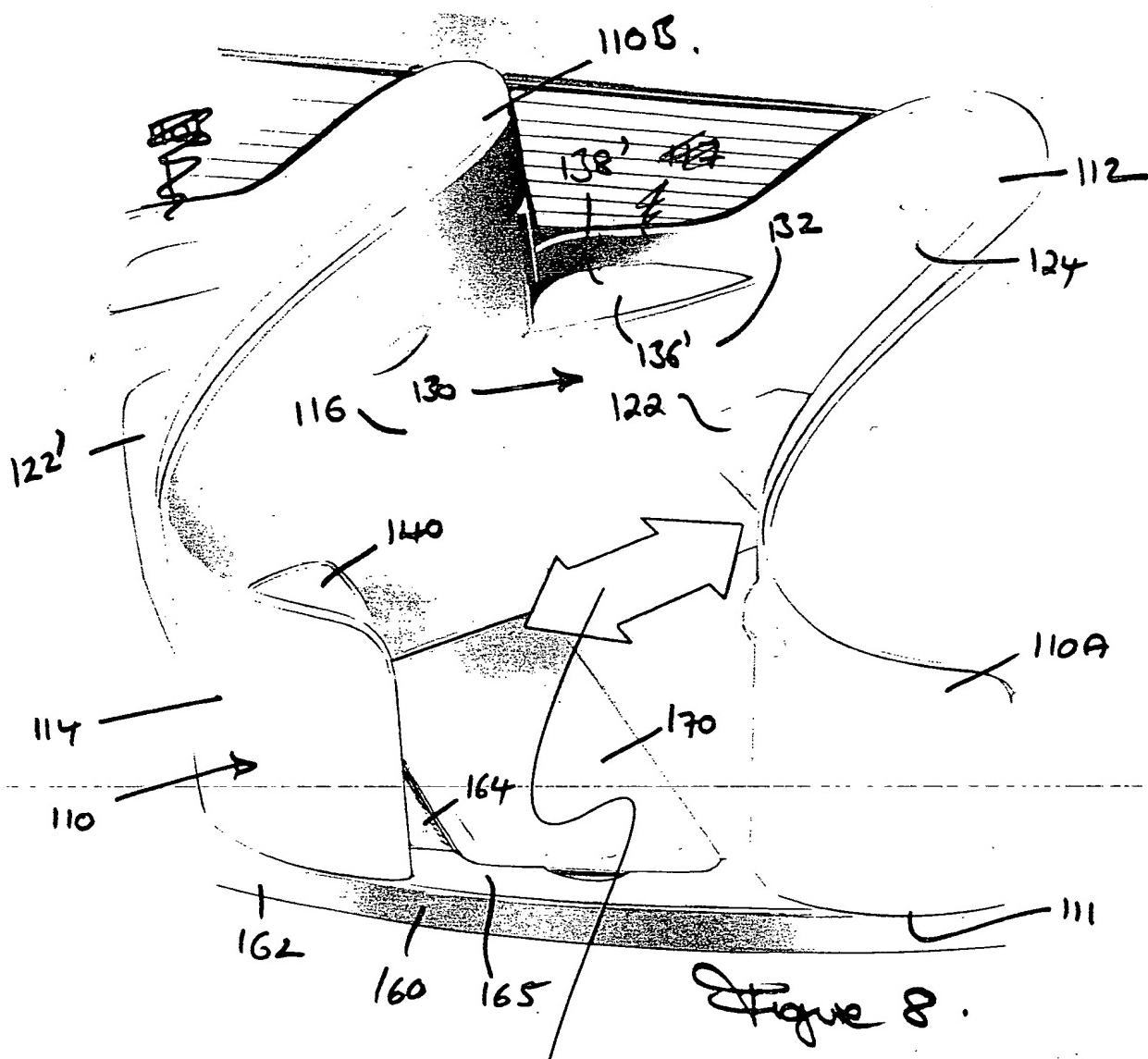
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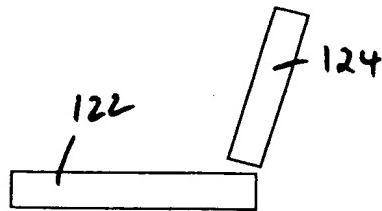


The above images shows the positions of the seat and floor bed and how they would be used by passengers

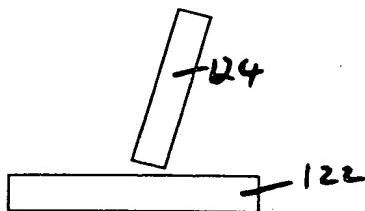
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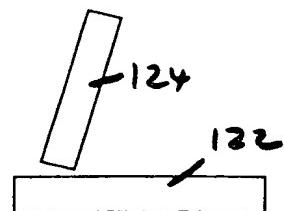
Seat-pan slides horizontally to accomodate differently sized passengers and to provide different modes of operation. Fully extended seat-pan = lounge chair setting. Half way extended seat-pan = dining chair setting. Fully slid back seat-pan = sleeping mode so that the seat is out of the way when using the floor-bed.



lounge mode

Figure 9A

dining mode

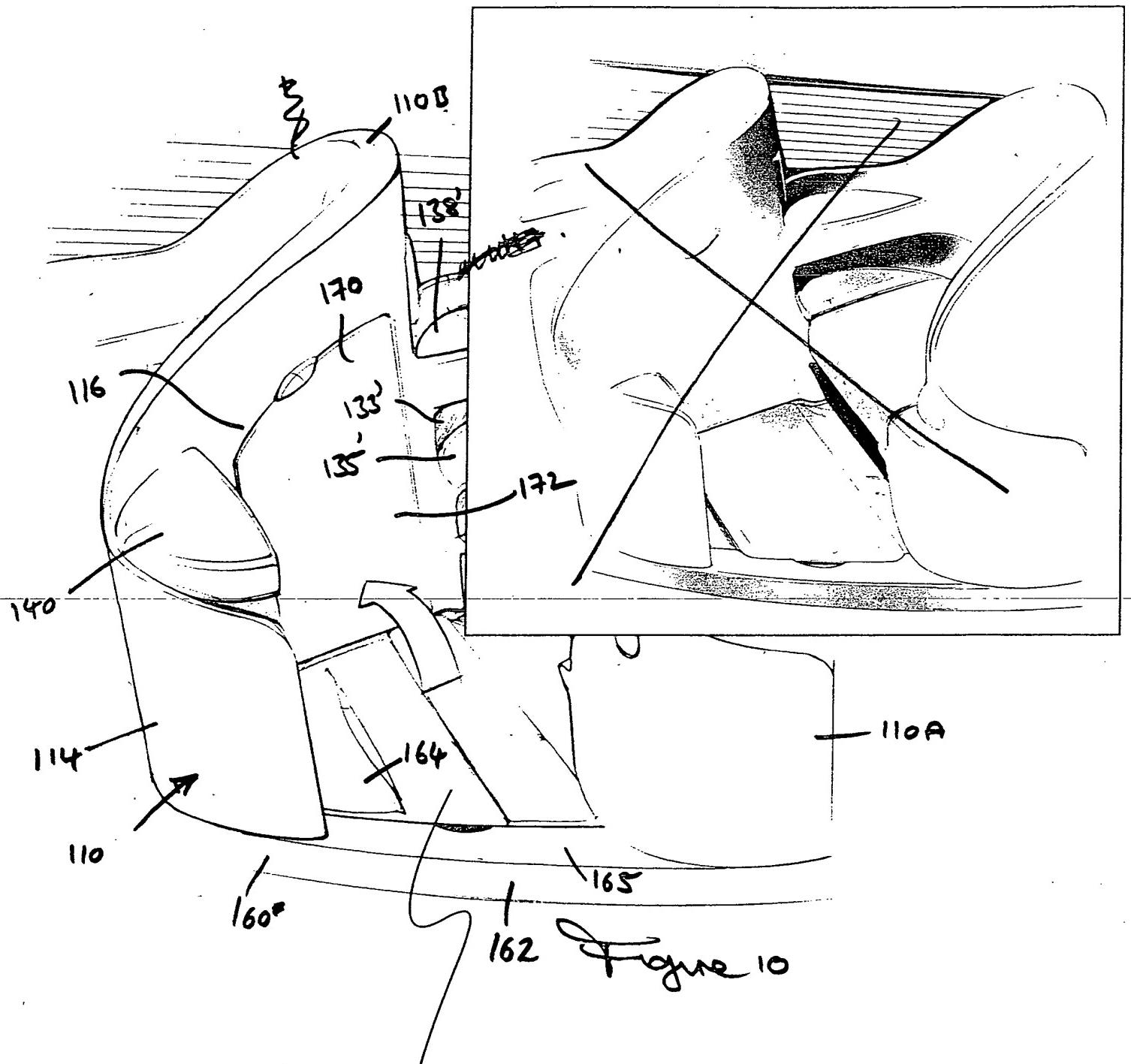
Figure 9B

sleeping mode

Figure 9C

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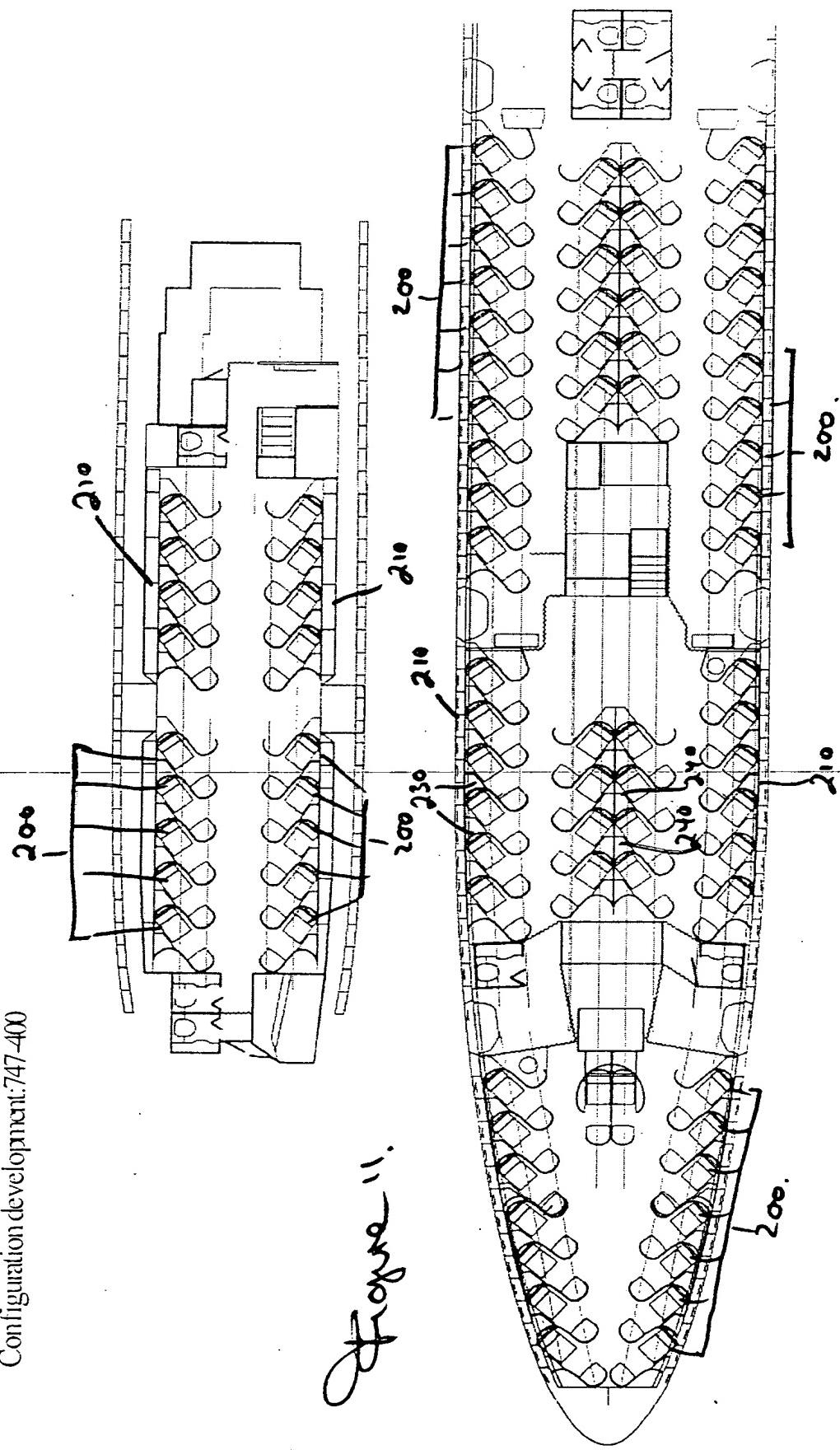


Raised floor is hinged so that it can be opened upwards to allow access to the bed below, and so that it is stored flush with the unit's walls with a clip feature.

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LOPA

Configuration development: 747-400



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